

Rebuilding Lancair Hydraulic Cylinders

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The main Lancair cylinder contains four different seal types, static O-rings, a Piston T-seal, a shaft seal and sealing washer. While any one of these can leak, the most common are the dynamic seals. The sealing washer on the piston (not present on the smaller gear door cylinders) can also fail and leak.



Here is the cylinder removed from the aircraft. The hydraulic fluid can be pumped out by moving the piston back and forth.



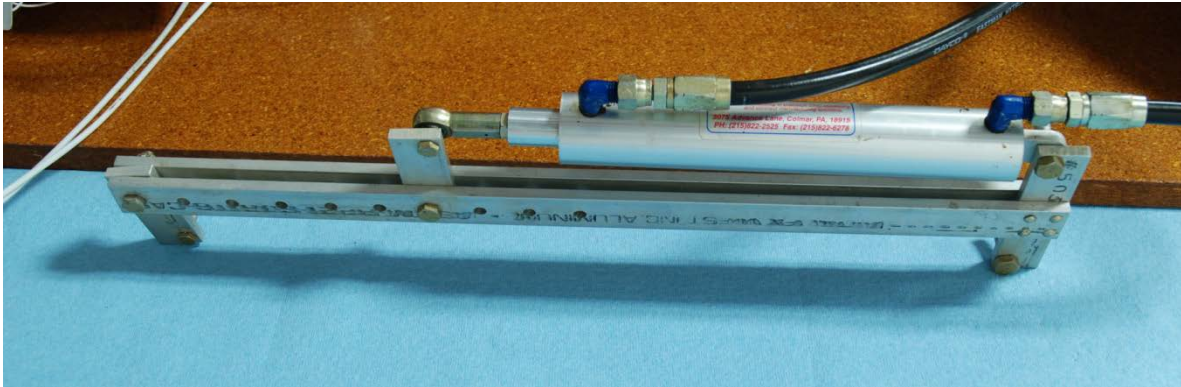
Above are some of the items you'll need: Parker O-Lube, Loctite 565 or equivalent, snap ring removal tool, seal pick and a set of new seals



If a means of pressurizing the cylinder is available, the above device will precisely record the length of the cylinder in both the retracted and extended positions. After the cylinder is reassembled the rod end bearing is set to the recorded length. This eliminates the need to make adjustments on the plane. This only works if the cylinder is pressurized so that all slack is removed and the parts are loaded as when installed. Simply extending or compressing the cylinder by hand will not work.



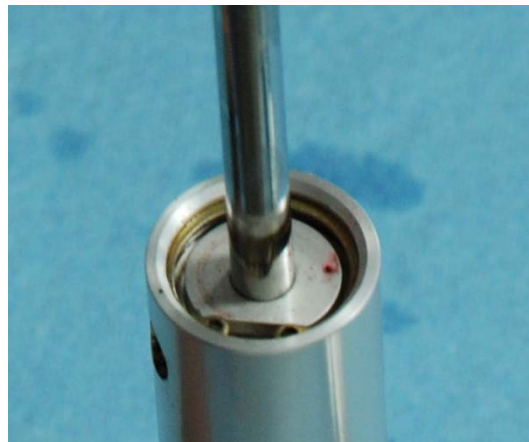
Here the extended length being captured. Tightening the bolt locks in the length.



Now the retracted length being recorded.



Pipe fittings are ready to be removed.



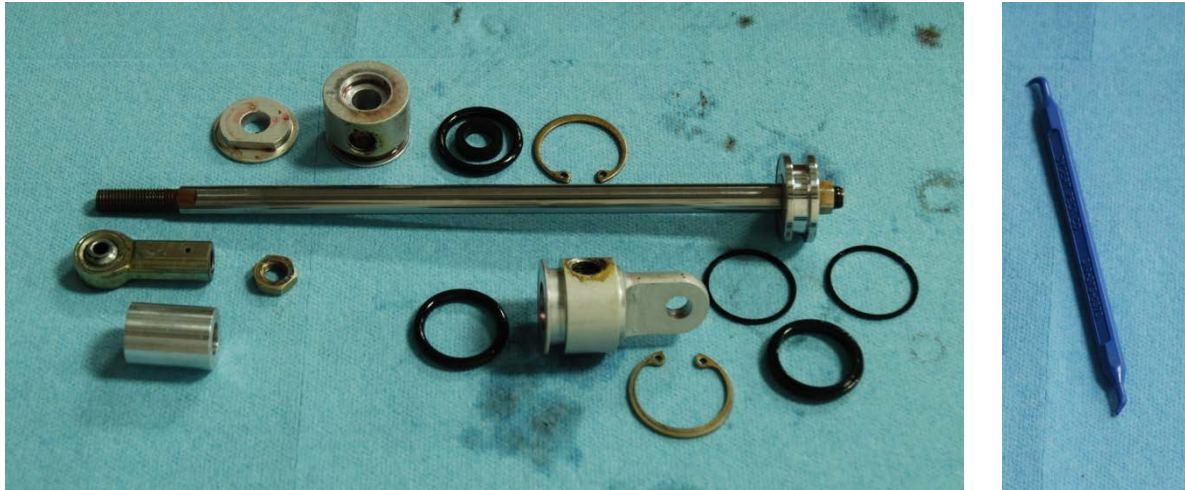
In order to remove the internal snap ring, the end plug must be pushed in beyond the snap ring.



With the snap ring removed, pull out the piston assembly.



Use the same technique of pushing the end plug into the cylinder to remove the other side.

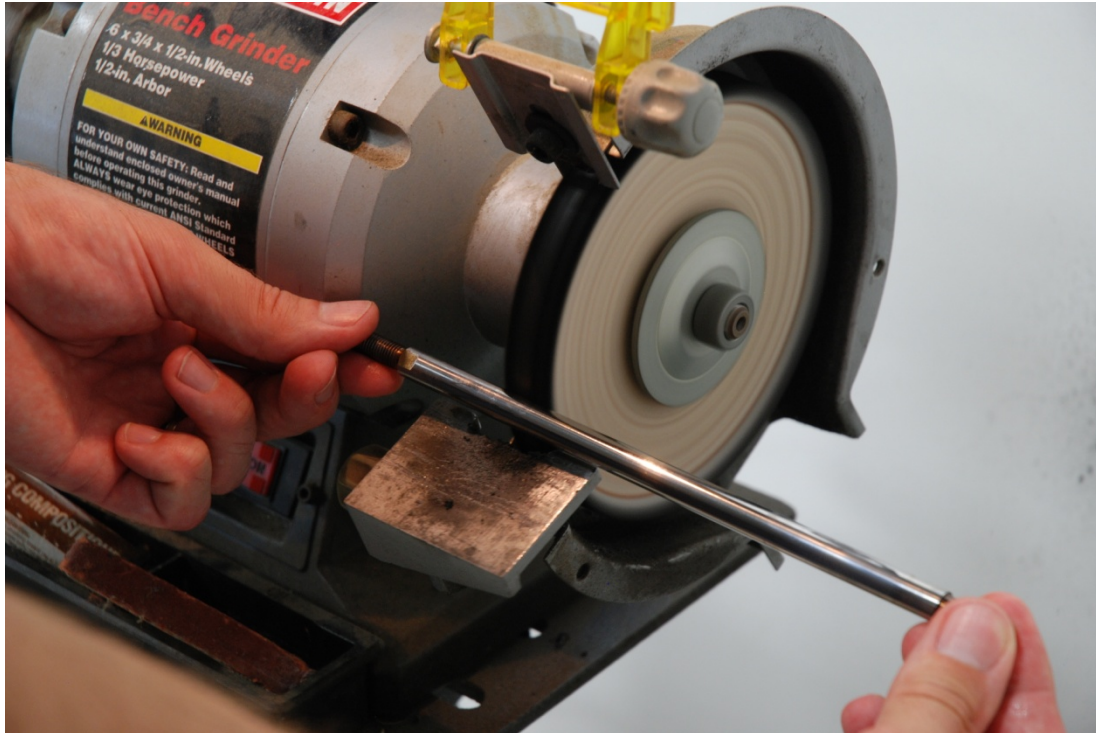


Use the seal pick to remove the o-rings and seals. Never use a metal object of any kind. Doing so can easily scratch the sealing surface and cause costly damage.



Now the piston can be removed. It contains the last seal, a sealing washer under the piston nut. The opposite end of the shaft has flats for clamping in a vise.

Most leaks are associated with some kind of surface damage to a sealing surface. These can be the direct source of the leak or they will have abraded the seal itself until it was unable to function properly. External leaks at the shaft seal are a good indication of a scratch on the shaft. Internal leaks are usually caused by damage to the cylinder bore, but may also originate at the piston sealing washer. Simply replacing seals when damage is present will lead to the leak returning. Surface damage needs to be removed to prevent the new seal from being damaged and suffering premature failure.



A buffing wheel and polishing compound will remove most scratches from the shaft. Deep scratches may require wet sanding prior to buffing.



Every sealing surface should be inspected and polished to assure a good seal. The cylinder bore also needs to be carefully inspected. Looking through the bore at a well lit area will reveal scratches.



Surface Finish Comparison				
RMS (Micro-inch)	RMS (Micron)	Ra (Micro-inch)	Ra (Micron)	Grit Finish
160	4.06	142	3.61	36
98	2.49	87	2.21	60
80	2.03	71	1.80	80
58	1.47	52	1.32	120
47	1.20	42	1.06	150
47	1.20	42 Before Bead Blast	1.06	USDA Bead Blast
34	0.86	30	0.76	180
21	0.53	19	0.48	220
17	0.43	15	0.38	240
14	0.36	12	0.30	320
10	0.25	9	0.23	400
5	0.13	4 (+/-)	0.10	Mirror

Home-made honing tools can be fabricated using sand paper of various grits ranges. 360 through 1,000 grit works well for both removing scratches and then polishing and honing. Initially cleaning the bore with a fine grit will make the deeper scratches quite visible. The desired surface finish for the cylinder is 5-20 micro-inches.



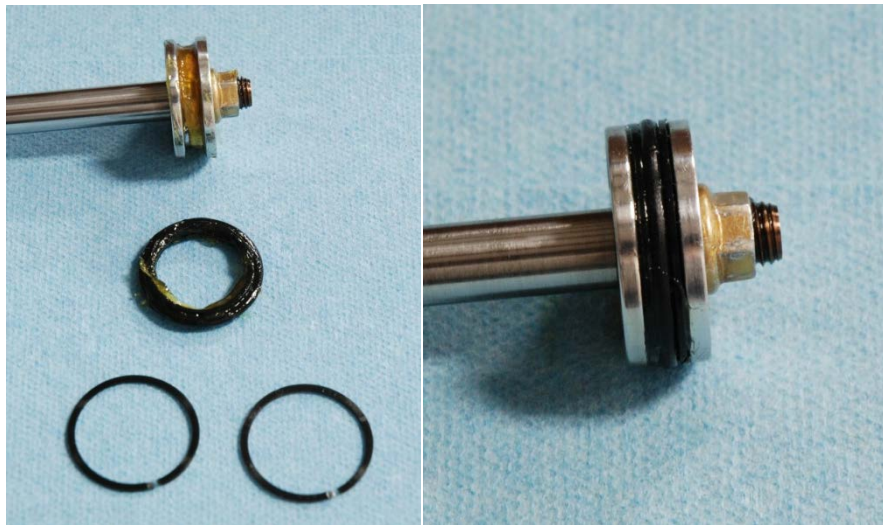
A drill press and WD40 as a cutting fluid work well to remove scratches and then polish the interior surface.

Reassembly

Parker O-Lube is used on every seal during reassembly of the cylinder. It acts as a lubricant and protects the seals from damage while being stretched or slid into position.



The sealing washer is installed with a generous amount of Parker O-Lube. This prevents damage during tightening of the nut.



Parker O-Lube used on the piston seal during reassembly.



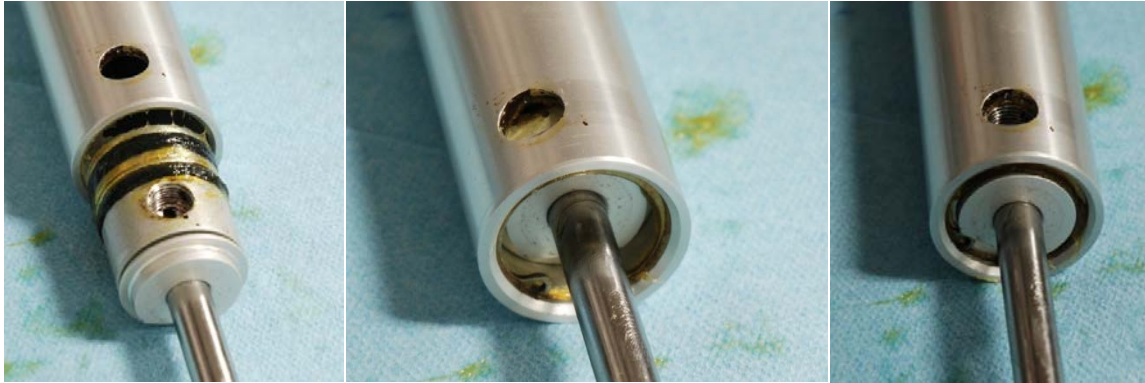
End plugs with Parker O-Lube and new O-rings installed



The closed end plug can be reinstalled. Align the threaded port with the hole in the cylinder and push the plug in far enough to reinstall the snap-ring. Finally, pull the plug back out up against the snap-ring.



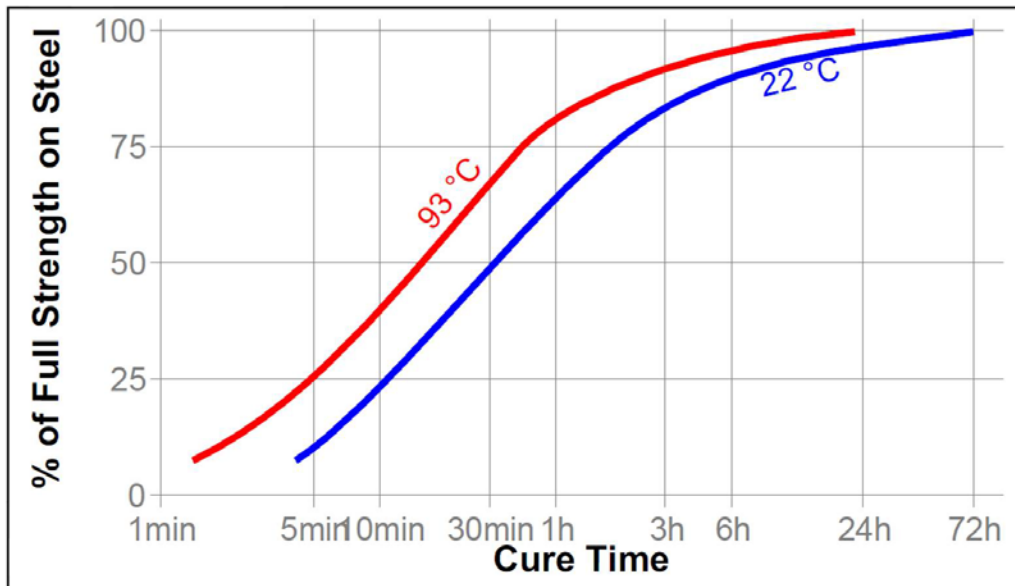
The rod end plug can now be slid onto the shaft such that the shaft seal bore is visible. The shaft seal is flared such that when confined to its nominal dimensions it exerts some pressure against the sealing surfaces of both the plug and the shaft. This makes it a little challenging to install. One option is to slide the lubricated seal onto the shaft and then use a tongue depressor or similar to work the lip of the seal into the plug cavity.



Slide the retaining plate onto the shaft and with a generous quantity of O-Lube work the assembly into the cylinder. Again, align the fitting port and the hole in the cylinder wall, but push the assembly in far enough to install the snap ring. Finally, pull the piston assembly and plug back up against the snap ring.



The last step is to reinstall the AN fittings. Loctite 565 work very well. It is an anaerobic thread sealer so excess sealant on the exterior will not cure and should be wiped off.



It is preferable to let the Loctite cure 24 hours before use, although it can be put back into service sooner in a pinch. After just 1 hour more than half of its strength has been obtained.